

REMARKS

Claims 29-57 are pending in this application. As recited therein, the present invention relates to a method of forming a hollow fiber membrane module. More particularly, it relates to a method of making a hollow fiber module wherein the fibers and potting compound are both formed of one or more thermoplastic, perfluorinated resins.

The claims have been amended to correct minor typographical errors and to provide proper antecedent basis. Claims 33 and 34 were amended to correct spelling errors. Claims 49, 50, 52 and 54 have been amended to reference hollow fiber tubes that are "free of inorganic fillers." Support for this amendment comes from the specification as filed, and no new matter was added by virtue of the amendments made to the claims.

Claims 49, 50 and 52 are rejected under 35 U.S.C. §102(b) as being clearly anticipated by, or in the alternative, under 35 U.S.C. §103(a) as obvious over the EP patent 0 299 459 A2. This action is respectfully traversed.

Claims 49, 50 and 52 are neither anticipated by nor obvious with respect to the EP patent 0 299 459 A2. In the EP patent, a perfluorinated hollow fiber membrane cartridge is taught and claimed. Specifically, perfluorinated hollow fibers filled with an inorganic filler, as described by Japanese Patent App. No. 62-106808, are used to prepare the filter assembly. (Pg. 6, lines 15-18). The EP patent, in the discussion of related art, describes problems with hollow fibers shrinking when heat is applied and the effect on filter performance as a result. (Pg. 3, lines 16-40). Additionally, the EP patent discusses the advantage of having the inorganic filler present to prevent such shrinkage when the fibers are heated. (Pg. 6, lines 37-40). While the EP patent teaches that the product of the

hollow fibers in a filter assembly may use the same or different thermoplastics (Pg. 4, lines 35-39 and pg. 7, lines 30-36), the EP patent product differs from the currently claimed invention in that the claimed product is essentially free of such inorganic fillers as used in the EP patent.

The preferred processes used to make the claimed hollow fluorocarbon fibers are taught in the specification. See, for example, Pages 5 and 6, which refer to the teachings of U.S. Patent Nos. 4,902,456 and 4,990,294, as well as two U.S. Provisional Applications, U.S.S.N. 60/117,852 and 60/117,854, each of which was incorporated in the current application by reference. The methods taught in these references provide processes for producing hollow fluorocarbon fibers **without the use of inorganic fillers**. In the background of the invention of the '456 and '294 patents, the use of inorganic fillers for hollow fiber manufacturing is described as "*highly undesirable* since all of the fillers cannot be removed by solvation and the fillers remaining may migrate into the filtrate and contaminate it." The resulting product produced in the current application is clearly "free of inorganic fillers" - since no such inorganic fillers are used in the production of the hollow fibers used herein.

By contrast, not only are filler-containing hollow fibers used in the EP patent (referencing Japanese Patent App. 62-106808), their use is required by the teaching since "[t]he filler in the membranes has an effect of preventing the membranes from shrinking when the membranes are heated." (EP '459, Pg. 6, lines 37-38). Additionally, the EP patent suggests that multiple extractions may be needed to achieve "complete" removal of the fillers, but no data is presented in the EP patent to support full removal as would be required to produce the assemblies of Claims 49, 50 and 52. (EP '459, Pg. 6, lines 55-58 and pg. 7, line 1).

The Federal Circuit, in the case of *In re Marosi et al*, held “[w]here a product-by-process claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product.” *Marosi*, 218 U.S.P.Q. 289, 292-93 (Fed. Cir. 1983). In *Marosi*, the court held the rejection of the claim was valid since the applicant failed to produce any data to support the “unobvious difference” between the two products. *Id.* at 293.

Clearly, judging from the amount of fillers used in making the fiber (the volume ratio of fiber polymer to fillers is 1.9 : 1 as described in EP ‘459 Example 1) which is substantial, it would be very difficult to remove all of the fillers used therein – particularly to an acceptable level for microelectronics applications. Moreover, the fillers used are all either metal (calcium, magnesium, aluminum) or silicon containing compounds, and also the lumen filling compound is gypsum which is calcium sulfate. If any minute residual amount of these unextracted fillers leaches out of the filter during use with semi-conductor processing fluids, they will have substantial negative impact for the user. The required metal cleanliness level for semi-conductor processing fluids is much less than 1 part per billion. Since the filters of the present invention are particularly useful and adapted for microelectronics applications, the present inventors never considered using fillers of the type employed in the EP ‘459 invention, let alone the copious amount of such fillers required as described therein.

The product of the current process is “free of inorganic fillers” since no inorganic fillers are used to produce the product. Since the products produced by the current process and those in the EP patent have clear “unobvious differences,” the currently amended claims cannot therefore be anticipated by the EP patent under 35 U.S.C. § 102, and the rejection based thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Likewise, the teachings of the EP patent cannot make the amended claims obvious - since the EP patent states that the use of the inorganic filler is critical to preventing shrinkage of the fibers. The cited prior art must be considered as a whole, including that which teaches away from the claims when considering obviousness. MPEP § 2141.02; *also see W.L. Gore & Assoc, Inc.. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983). While the EP patent produced a filter assembly using hollow fibers, the current filler-free assembly could not be obvious therefrom, since the shrinkage problem, as taught by the EP patent, would appear to be present if the required inorganic filler is not used. The amended claims are therefore not obvious based upon the EP patent under 35 U.S.C. §103, and rejection based thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Claims 54, 55 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yagihashi et al (US 5,885,454) in view of the EP patent 0 299 459 A2. This action is respectfully traversed.

Yagihashi et al in US 5,885,454 teaches various methods of forming hollow fiber bundles of high packing density using strips of potting material that are subsequently melted at the bottom and softened towards the top of the strip to bond the hollow fibers into a filter assembly. (Col. 4 lines 33-62). Any closure of the hollow fibers is corrected by cutting off of the bottom a section of the assembly where the potting material has been melted to re-open the tubes. (Col. 13, lines 65-67 through col. 14, lines 1-4). More specifically, Yagihashi et al teaches the use of polyethylene films as potting materials, however the claims are not limited polyethylene thermoplastics. (Col. 13, lines 4-30, Claim 4). Polyethylenes typically have melting ranges between 85°C and 110°C (Merck Index, 11th ed., pg. 1204, Merck & Co., 1989), while perfluorinated thermoplastic resins have melting temperatures around 100°C higher than polyethylenes, but just short of the melting temperatures of the perfluorinated hollow fibers. (Current application, pg. 7, lines

3-17). Yagihashi is silent on the use of perfluorinated thermoplastic resins specifically in this process, but in other methods of producing the assembly as described in the patent, an inorganic filler is used. (Col. 14, lines 39-51).

EP '459 teaches the use perfluorinated hollow fibers configured for a filter assembly where the fibers are bonded together using, but not limited to, perfluorinated thermoplastics. (Pg. 7, lines 30-36). the EP patent, however, uses hollow fibers filled with an inorganic filler, specifically, perfluorinated hollow fibers filled with an inorganic filler as described by Japanese Patent App. No. 62-106808. (Pg. 6, lines 15-18). the EP patent, in the discussion of related art, describes problems with hollow fibers shrinking when heat is applied and the effect on filter performance as a result of the shrinkage. (Pg. 3, lines 16-40). Additionally, the EP patent discusses the advantage of having the inorganic filler present to prevent such shrinkage when the fibers are heated. (Pg. 6, lines 37-40).

When combining prior art under 35 U.S.C. §103(a), it is important whether the prior art, without the use of hindsight, suggests the desirability or motivation of their combination to produce the invention as a whole. MPEP §2141. The art must teach or suggest the proposed combination as well as support a reasonable expectation of success. MPEP §2142. The patent application itself cannot be used to support the combination of prior art. *Id.* Prior art must be considered as a whole, including that which teaches away from the claims when considering obviousness. MPEP §2141.02; *also see W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983).

While the EP patent produced a filter assembly using hollow fibers, the current filler-free assembly could not be obvious since the shrinkage problem, as taught by the EP patent, would appear to be present if the inorganic filler was not used. Yagihashi et al does not make the current process obvious since the thermoplastic used (polyethylene)

melts much lower than the perfluorinated thermoplastic resins of the current invention. While Yagihashi is silent on the use of other thermoplastics closer to the melting point of the hollow fiber, one of ordinary skill would be aware of the significantly higher melting temperature of perfluorinated thermoplastics, and is taught away by the EP patent from attempting perfluorinated thermoplastics with melting temperatures closer to that of the hollow fibers without the use of inorganic filler. While hindsight may show the use of perfluorinated thermoplastic resins can be used with perfluorinated hollow fibers as in the current invention, both hindsight and the current application cannot be used to overcome the fact the EP patent teaches away from the current invention.

Since the process to use perfluorinated thermoplastic resins is not obvious based upon the prior art, the packing density achieved by the current process could not be taught by Yagihashi. While there may be an optimum density for this type of filter, the possible packing densities achievable by any process are process dependent. Since these claims are not taught by Yagihashi, even in light of the EP patent, the packing density could not be considered only an optimization of a known product. As such, Claims 54, 55 and 57 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Claims 29-48, 51-53 and 54-56 are rejected under 35 U.S.C. §103(a) as being unpatentable over Huang et al (US 5,284,584) in view of the EP patent 0 299 459 A2. This action is respectfully traversed.

Huang et al (US 5,284,584) teaches methods of making cylindrical filter cartridges by extruding molten thermoplastic resin onto a hollow fiber membrane in a fabric array, having both warp and weft fibers, as the membrane is spiral-wound and subsequently cut to expose the lumen ends. (Col. 4, 12-43). While not limited to certain thermoplastics, Huang's preferred embodiment uses polyolefins. (Col. 5, lines 56-57).

Embodiments in the patent include polypropylene and polyethylenes. (Col. 11, lines 49-68). The patent is silent on specifically using perfluorinated thermoplastic resins.

EP '459 describes a filter element comprised of parallel hollow fiber membranes, with one end potted with a thermoplastic resin, including perfluorinated thermoplastic resins. (Pg. 4, lines 24-39). The EP patent, in the discussion of related art, describes problems with hollow fibers shrinking when heat is applied and the effect on filter performance as a result of the shrinkage. (Pg. 3, lines 16-40). Additionally, the EP patent discusses the advantage of having the inorganic filler present to prevent such shrinkage when the fibers are heated. (Pg. 6, lines 37-40). While the EP patent covers the product of the hollow fibers in a filter assembly using the same or different thermoplastics (Pg. 7, lines 30-36), the current process does not use the inorganic filler as required for the formation of the hollow fibers as taught by the EP patent.

Huang, in light of the EP patent, does not make obvious the process of the current invention since the EP patent suggests that the use of perfluorinated thermoplastic resins, absent the inorganic filler, would shrink and become unusable. One of ordinary skill in the art, in light of the EP patent, would be dissuaded from attempting the Huang process since the shrinking, especially at or near the melting point of the polymer, would cause failure of the potting or poor performance of the filter. Additionally, Huang states the "principal benefit of incorporating the hollow fibers into a fabric-like array rather than using loose fibers is the fabric structure holds adjacent hollow fibers in a spaced-apart, mutually parallel relationship." (Co. 7, lines 7-11). One of ordinary skill in the art, in light of the weave structure, may be dissuaded from using the parallel construction of the current invention, absent the "weft" fiber, since the fibers may upon heating near the melting point shrink or slump without the support of the weave structure.

When combining prior art under 35 U.S.C. §103(a), it is important whether the prior art, without the use of hindsight, suggests the desirability or motivation of their combination to produce the invention as a whole. MPEP §2141. The art must teach or suggest the proposed combination as well as support a reasonable expectation of success. MPEP §2142. The patent application itself cannot be used to support the combination of prior art. *Id.* Prior art must be considered as a whole, including that which teaches away from the claims when considering obviousness. MPEP §2141.02; *also see W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983).

Specifically as to Claim 29, while Huang et al teaches the use of thermoplastics as potting materials for weaved hollow fiber membranes, the EP patent teaches away from the use of perfluorinated hollow fibers without the inorganic filler. While, using hindsight, the teachings in Huang are similar to the current process, the current process is not obvious in light of Huang since the EP patent teaches away from that which is suggested, but not exemplified by Huang. As such, Claim 29 is not obvious under 35 U.S.C. §103(a), and the rejection based thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 30-32, since they are dependent on Claim 29, and Claim 29, discussed above is nonobvious, so too are Claims 30-32. MPEP §2143.03. Even so, Claims 30-32 cannot be obvious since Huang provides a range appropriate for polypropylene (Col. 11, lines 20-32), and the EP patent provides a range preferably 80% to 120% of the softening point (melting point if crystalline) of the thermoplastic (pg. 7, lines 30-37), but the EP patent also teaches the use of inorganic filler in the process with perfluorinated thermoplastics due to shrinkage and collapsing of the tubes. (Pg. 6, lines 37-40). One skilled in the art would be dissuaded from using the range suggested by Huang, especially in light of the EP patent, since the EP patent teaches that heating without filler will result in undesirable results. While in hindsight the ranges overlap, the

fact that the EP patent teaches away from the range suggested by Huang makes such range nonobvious. As such, Claims 30-32 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 33 and 34, since they are dependent on Claim 29, and Claim 29, as discussed above is nonobvious, so too are Claims 33 and 34. MPEP §2143.03. As such, Claims 33 and 34 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 35 and 36, since they are dependent on Claim 29, and Claim 29, as discussed above is nonobvious, so too are Claims 35 and 36. MPEP §2143.03. Even so, Huang uses a hollow fiber membrane fabric, preferably composed of polyolefins. (Col. 6, lines 50-57). the EP patent uses a process to produce a filter membrane assembly, but no packing density is claimed. Since the packing density in Huang is for a fiber bundle produced from a fabric membrane, and the EP patent teaches perfluorinated thermoplastics, but produced by a different process from the current invention (i.e., using inorganic fillers), the desired packing density achievable cannot be derived from these sources since the process itself dictates the achievable packing densities. As such, Claims 35 and 36 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 37 and 38, since they are dependent on Claim 35, and Claim 35, as discussed above is nonobvious, so too are Claims 37 and 38. MPEP §2143.03. Even so, while the EP patent teaches fluoropolymer thermoplastics (pg. 4, lines 36-39), they are not used without inorganic filler, and such use, as described above,

is actually taught against. (Pg. 6. lines 19-21 and 37-40). As such, Claims 37 and 38 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claim 39, since it is dependent on Claim 35, and Claim 35, as discussed above is nonobvious, so too is Claim 39. MPEP §2143.03. As such, Claim 39 is not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 39-43, since they are all originally dependent on Claim 29, and Claim 29, as discussed above is nonobvious, so too are Claims 39-45. MPEP §2143.03. Even so, while Huang teaches a membrane array, such array is a fabric weave, having both warp and weft. (Col. 7, lines 6-44). The current invention produces an array that has hollow fibers in a parallel construction. (Current App., Pg. 8, lines 13-18). While an array is formed in the current invention, it does not possess the “weave” taught by Huang, and such a “weave” is described as advantageous by Huang. (Col. 7, lines 6-16). Even in light of the EP patent, which uses a parallel construction, production of the current invention would require a process absent the “weave” configuration taught by Huang and inorganic filler, as discussed above, taught by the EP patent. As such, Claims 39-43 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 44-45, since they are dependent on Claim 29, and Claim 29, as discussed above is nonobvious, so too are Claims 44-45. MPEP §2143.03. As such, Claims 44-45 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claim 46, while Huang et al teaches the use of thermoplastics, the embodiments are directed at polyolefins. (Col. 13, lines 25-31). While Huang

suggests the process described for polyolefins is applicable to other thermoplastic resins (Col. 13, lines 25-31), the EP patent '459 dissuades the use of perfluorinated hollow fibers without inorganic filler. (Pg. 3, lines 16-40). One skilled in the art, knowing the perfluorinated thermoplastics typically melt at a significantly higher temperature than polyolefins, and that the EP patent '459 suggests a temperature range that is inclusive of the range suggested by Huang, would be dissuaded by the EP patent to use perfluorinated thermoplastics in the temperature range of the Huang process. Prior art must be considered as a whole, including that which teaches away from the claims when considering obviousness. MPEP §2141.02; also see *W.L. Gore & Assoc Inc., v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983). As such, Claim 46 is not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 47 and 48, since they are dependent on Claim 46, and Claim 46, discussed above is nonobvious, so too are Claims 47 and 48. MPEP §2143.03. As such, Claims 47 and 48 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claim 51, while Huang provides for a hollow fiber bundle assembled into a filter assembly, such assembly is designed to direct feed fluid through a core hollow mandrel fitted with a center plug equidistant from said mandrel ends. (Col. 19, lines 46-68 through col. 20, lines 20-23, figures 4, 5 and 6). The feed fluid is allowed to pass through the assembly, and only some is forced to permeate through the hollow fiber membranes to form filtrate. *Id.* The same is true for Figure 5 of the EP patent '459. The current invention, however, describes fluid flow that is entirely directed into the hollow fibers, and no feed fluid is allowed to flow through the filter assembly without passing through the membrane. (Pg. 14, lines 4-19, figure 6). Neither Huang nor the EP patent '459 teach, predict or suggest such total flow is possible or desirable. One skilled

in the art may reason, looking at both Huang and the EP patent, that these flow-through embodiments are preferred due to, for example, flow and pressure restrictions of the hollow fibers, or the resulting backpressure caused by total flow through the fibers. As such, the construction of a filter assembly as described by Claim 51 is not obvious under 35 U.S.C. §103(a), and therefore such rejection should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claim 53, since it is dependent on Claim 46, and Claim 46, discussed above is nonobvious, so too is Claim 53. MPEP §2143.03. As such, Claim 53 is not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claim 54, while Huang teaches a method of making a hollow fiber bundle, the bundle is formed by winding upon an axis a hollow fiber membrane fabric composed of both a warp and weft arranged substantially perpendicular to each other. (Col. 4, lines 12-24). While the warp and weft fibers are substantially perpendicular such that either may be parallel with the axis upon winding, the addition of molten or heated potting material is different than the current invention since the fabric membrane in Huang is held together by the weave of the fabric, and no suggestion is made in Huang that absent the weave, the process is possible. Additionally, Huang, while not limited to polyolefins, only provides examples for polyolefins. the EP patent, however, teaches that heating the perfluorinated hollow fibers may cause shrinkage when no inorganic filler is used, and this shrinkage may lead to poor filter performance. (Pg. 3, lines 16-40 and pg. 6, 37-40). One skilled in the art, based upon the teachings of Huang in light of the EP patent, would be dissuaded from placing molten or heated perfluorinated thermoplastics on hollow fibers composed of perfluorinated thermoplastics, no less hollow fibers not contained in a weaved fabric. Since Huang and the EP patent do not teach, suggest or predict the contents described in Claim 54, Claim

54 is not obvious under 35 U.S.C. §103(a), and the rejection based thereon should be reconsidered and withdrawn. Such action is respectfully requested.

Specifically as to Claims 55 and 56, since they are dependent on Claim 54, and Claim 54, discussed above is nonobvious, so too are Claims 55 and 56. MPEP §2143.03. Even so, claims 55 and 56 provide further detail for Claim 54, and such detail is not taught, suggested or predicted by either Huang or the EP patent. As such, Claims 55 and 56 are not obvious under 35 U.S.C. §103(a), and rejection thereon should be reconsidered and withdrawn. Such action is respectfully requested.

INFORMATION DISCLOSURE STATEMENT

Applicant has received an action from the European Patent Office in a related counterpart application. The EPO has cited four references; EP A-0803281 (D1), JP A-4354521 (D2), US 5695702 (D3), and EP A-0299459 (D4). References D1, D2 and D3 are newly cited herein. A copy of Form PTO-1449 is attached. Copies of references D1 and D2 are being submitted under separate cover. No copy of the US Patent (D3) is being submitted.

FEE AUTHORIZATION

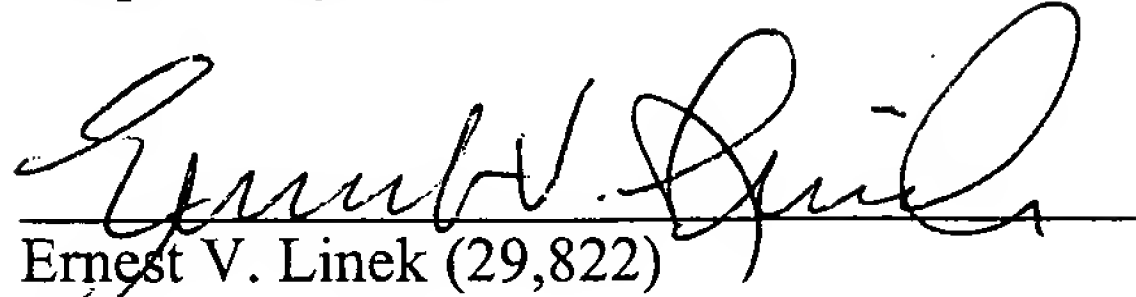
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CERTIFICATE OF FACSIMILE TRANSMISSION

The undersigned hereby certifies that this correspondence was submitted by facsimile in the USPTO on the date shown on Page 1.

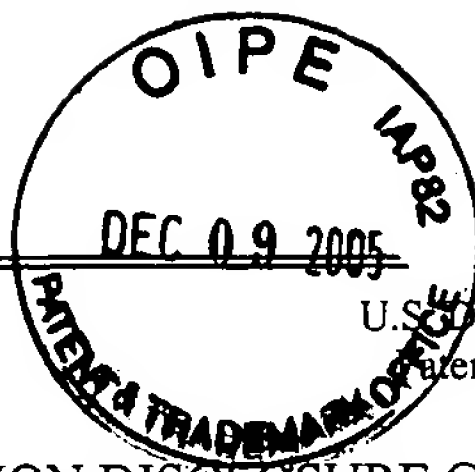
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Respectfully submitted,

A handwritten signature in black ink, appearing to read "Ernest V. Linek", written over a horizontal line.

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INFORMATION DISCLOSURE CITATION

Sheet 1 of 1

Applicant(s): Yen et al.

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U.S. PATENT DOCUMENTS

Examiner Initial		Patent No.	Date	Name	Class	Subclass	Filing Date (if appropriate)
	AA	5,695,702	12/0/1997	Niermeyer	264	129	07/01/1994

FOREIGN PATENT DOCUMENTS

Examiner Initial		Document No.	Date of Publication	Country	Class	Subclass	Translation	
							YES	NO
	AB	EP-A-0803281	10/29/1997	EPO	B01D	63/02		
	AC	JP-A-4354521	08/12/1992	Japan	B01D	63/02		X
	AD	EP-A-0299459	01/18/1989	EPO	B01D	13/01		

OTHER DOCUMENTS (including Author, Title, Date, Pertinent Pages, etc.)

	AE	English Abstract of JP-A-4354521

EXAMINER

DATE CONSIDERED

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.**Copies of references not provided at the time of this submission.